DESIGN SUMMARY
LAKE TIPPECANOE
HENWOOD CREEK RESTORATION

December 17, 1999

Prepared for:

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I. PROJECT DESCRIPTION AND PURPOSE

The proposed project involves the restoration of Henwood Creek and the Hanna B. Walker Drain, a tributary of Lake Tippecanoe, using bio-engineering techniques in an attempt to reverse the severe erosion of the banks caused by channel incision. This technique utilizes stone grade controls to raise the bed of the channel back up to its original height allowing the flood flows to spread the energy of erosion throughout the floodplain rather than concentrating them with in the defined channel as they are currently. The restoration is designed to reduce the sediment transport to the lake and allow these nutrient laden sediments to be deposited in the floodplain.

II. DESIGN RATIONALE

Henwood Creek, which feeds Hanna B. Walker Drain before emptying into Lake Tippecanoe, is a source of high nutrient and sediment loads to Lake Tippecanoe. The deposited sediment is creating sediment bars and dense European water milfoil beds at and beyond the mouth of this drain. The proposed project is a long term, restoration effort to reverse the erosion process and prevent sediment and nutrients from reaching the lake. The project involves several steps.

Grade control structures are proposed to stop the incision and head cutting that is currently causing total bank failure even along densely wooded portions of the channel. The grade controls are spaced at locations along the channel where nick points have formed causing successive deepening of the channel. By raising the channel bottom up at these strategic locations all kick points can be eliminated or armored enough that they will no longer erode. The shape of each grade control, forces the thalweg of the channel to remain at the depth and location of the lowest crest stone. Therefore the placement and size of the central crest stones are critical to the performance and life span of the project. A portion of the channel was not suitable due to its extremely degraded state. The building of a new channel allows the development of an appropriate channel size and cross section which will maintain base flow and allow any flows over the two year event to spread out across the floodplain.

A sediment trap will be constructed downstream of the restoration activities to collect sediment, particularly during construction activities. The upstream end of the trap will be stabilized by driving sheet pile to the grade and up the slopes of the existing stream bed and banks. It is expected that this trap may need to be cleaned every one-two years until the channel is stabilized after five years.

III. DESIGN SPECIFICS

A. Grade Control Structures

A profile and cross sections of the channel was surveyed and compared with an ideal (straight line) profile to identify kick points and areas of severe incising. Grade control structures were placed at strategic points along the profile to fit the ideal profile as close as possible. This ideal profile was a line which averaged two feet below the average top of bank height. The structures are spaced such that water which is backed up by the crest stone of one grade control will be at the same elevation as the foot of the upstream grade control structure. The elevations of the crest stones are critical to the design.

Rock grade control structures are designed to emulate the low riffles of stable creeks. They perform multiple functions by stabilizing the creek bed, providing habitat, providing reaeration, and creating natural pools and riffles. The rocks within the crest stone are sized such that observed flows (indicated by physical features on the banks) will not mobilize them. The flat slope on the downstream side of the crest stone is to ease the grade transition from the crest stone to the existing stream bottom (15:1 slope minimum). The upstream angled crest stones and the fact that they slope upward to the bank force the thalweg or center of the channel to remain in the center. Therefore, the angle and slope of the crest stone is also critical to the design, and is preserved by the flat slope of rock downstream of the crest.

B. New Creek Channel

The lower reach of Henwood Creek is severely eroded and the banks thickly wooded that the decision was made to re-construct the channel in a new location. An adjacent field provides an ideal location to re-route the creek. The area is open-field, low-land area with existing natural wetlands. The proposed creek will wind through the field following the overall grade until re-joining Henwood Creek just prior to Hanna B. Walker legal drain. The channel will be lined with erosion control blankets and 3" to 6" river rock. New trees, shrubs and native grasses will also be planted along the entire length of the channel.

The two-year, bankfull flood elevation was estimated along the entire length of Henwood Creek. The creek was walked several times and measurements taken. The two-year, bankfull flood elevation cross-sectional area varied from 10 sf to 19 sf. The new creek channel was designed to carry the two-year flood at capacity. An approximate cross-sectional area of 16 sf was chosen. During larger storm events, the creek will exceed its banks and flow into the wide, flat area of the field. This will facilitate the quick dissipation of energy and minimize the damaging effects of erosion.

All excavation from the construction of the new channel will be placed within the abandoned channel to help restore the landscape. Fill will initially take place within the old channel at the point of the proposed new channel and will proceed downstream. This fill will begin only after the new channel has had time to vegetate and all water has been diverted to the new channel.

C. Sediment Trap

A sediment trap of approximately 60 ft by 20 ft will be built just downstream of the union of Henwood Creek and Hanna B. Walker legal drain. The trap will collect sediment and reduce the load which reaches Lake Tippecanoe. PVC sheet pile will be used to protect and stabilize the upstream end of the sediment trap. Sheet piles of six foot length will be driven to grade within both Hanna B. Walker legal drain and Henwood Creek. The trap will angle to a depth of approximately four feet below existing grade but no closer than 10 feet from the sheet pile. The sheet pile shall not back water up thee stream or into the culvert.

D. Site Vegetation

Upon completion of the construction activities, all disturbed areas will be cleaned of unused rock and other debris. The areas that have bare soil will then be disced and drilled with an appropriate native grass mixture. Little bluestem, Indian grass, big bluestem, switch grass, and sedges will be dominant component of the seed mixture. Trees and shrubs will be planted as needed to replace damaged specimens and fill in open areas along the newly constructed channel. A minimum of one tree or shrub located every 10 feet along either bank will be necessary for project completion. Trees may be salvaged from on-site and replanted if they would otherwise be destroyed during construction.

IV. MAINTENANCE ACTIVITIES

The primary maintenance activity will be biennial inspection of the sediment trap by the landowner. When the trap is more than 60% full, mechanical dredging from the south side is required. The dredge spoils can be placed within the abandoned creek channel at the owner's direction as long as precautions are taken to ensure sediment is not re-introduced through erosion of spoil piles. As an alternative, the trap can be cleaned from he south side and spoils spread in the area immediately adjacent to the trap. After spoils are spread they shall be immediately seeded with a mixture of annual rye, fescue and brome and covered with straw mulch. It is expected that this activity will take no longer than one day for one operator to complete.